April – June, 2025
Original Article
DOI: http://dx.doi.org/10.30867/action.v10i2.2408

AcTion: Aceh Nutrition Journal
Pages: 324 – 333
p-issn 2527-3310; e-issn 2548-5741

Enhancing anthropometric skills and nutrition counseling through mentoring for adolescent Posbindu cadres

Peningkatan keterampilan antropometri dan konseling gizi melalui pendampingan pada kader Posbindu remaja

Sri Noor Mintarsih[1*], Ria Ambarwati[2], Zuhria Ismawanti[3], Sunarto[4], Mardiana[5], Anggi Ariana Wijayanti[6]

[1] Department of Nutrition, Semarang Health Polytechnic, Ministry of Health, Semarang, Indonesia.
E-mail: srinoormintarsih@gmail.com
[2] Department of Nutrition, Semarang Health Polytechnic, Ministry of Health, Semarang, Indonesia.
E-mail: riaambarwati@poltekkes-smg.ac.id
[3] Department of Nutrition, Semarang Health Polytechnic, Ministry of Health, Semarang, Indonesia.
E-mail: riazuhria27@gmail.com
[4] Department of Nutrition, Semarang Health Polytechnic, Ministry of Health, Semarang, Indonesia.
E-mail: sunarto@poltekkes-smg.ac.id
[5] Faculty of Medicine, State University of Semarang, Semarang, Indonesia, Indonesia.
E-mail: mardiana.ikm@mail.unnes.ac.id
[6] Department of Nutrition, Semarang Health Polytechnic, Ministry of Health, Semarang, Indonesia.
E-mail: anggi.arwijayanti@gmail.com

***Correspondence Author:**
Department of Nutrition, Semarang Health Polytechnic, Ministry of Health, Semarang, Indonesia.
E-mail: srinoormintarsih@gmail.com

Article History:
Received: February 18, 2025; Revised: February 18, 2025; Accepted: May 03, 2025; Published: June 11, 2025.

Publisher:
Politeknik Kesehatan Aceh
Kementerian Kesehatan RI

Abstract

Noncommunicable diseases (NCDs) pose a significant health threat to adolescents, including those in Semarang. The prevalence of NCD risk factors among high school students in Semarang highlights the urgent need for effective intervention. Empowering peer counselors as cadres through the Posbindu program can facilitate early detection of NCD risk factors. However, cadres' capacities for anthropometry and nutritional counseling remain inadequate. This study aimed to evaluate the impact of a structured mentoring program on enhancing knowledge and skills of adolescent Posbindu cadres in anthropometric measurements and nutrition counseling. This quasi-experimental study used a pretest-posttest control group design. A total of 36 students from grades 11 and 12 in two high schools in Semarang were recruited as cadres. The intervention consisted of lectures, demonstrations, and booklets. Data were collected through questionnaires measuring knowledge, anthropometric skills, and counseling abilities. A multivariate independent t-test was used for the statistical analysis. The mentoring program significantly improved knowledge, anthropometric skills, and counseling performance ($p<0,001$). Mentoring contributed to a 42% improvement in knowledge, 62% in anthropometric skills, and 64% in counseling abilities. Mentoring is an effective strategy for strengthening the competencies of Posbindu cadres in performing anthropometric assessments and providing nutrition counseling to support the early detection of NCD risk factors among adolescents.

Keywords: Posbindu cadres, knowledge, anthropometric skills, nutrition counseling

Abstrak

Penyakit tidak menular (PTM) menjadi ancaman kesehatan bagi remaja, termasuk di Semarang. Tingginya prevalensi faktor risiko PTM pada siswa sekolah menengah menekankan perlunya intervensi yang efektif. Pemberdayaan konselor sebaya sebagai kader pada program Posbindu dapat mendukung deteksi dini faktor risiko PTM. Namun, kapasitas kader dalam melakukan antropometri dan konseling gizi masih terbatas. Tujuan penelitian untuk mengevaluasi dampak program pendampingan terhadap peningkatan pengetahuan dan keterampilan kader Posbindu remaja di sekolah. Penelitian dilakukan pada tahun 2024 dengan desain pretest-posttest control group design. Jumlah sampel 36 siswa kelas 11 dan 12 dari masing-masing dua sekolah menengah di Semarang yang berperan sebagai kader. Intervensi yang dilakukan berupa program pendampingan terstruktur berupa ceramah, demonstrasi, dengan media booklet. Data pengetahuan, keterampilan antropometri, dan keterampilan konseling kader dikumpulkan menggunakan kuesioner. Analis menggunakan uji t independen multivariat. Pendampingan secara signifikan meningkatkan pengetahuan; keterampilan antropometri dan keterampilan konseling ($p<0,001$). Pendampingan

berkontribusi terhadap peningkatan skor pengetahuan sebesar 42%, keterampilan antropometri 62%, dan keterampilan konseling 64%. Pendampingan terbukti efektif meningkatkan kapasitas kader Posbindu dalam melakukan pengukuran antropometri dan konseling gizi. Strategi ini sebagai upaya untuk memperkuat peran kader dalam deteksi dini faktor risiko PTM pada remaja.

Kata Kunci: Kader Posbindu, pengetahuan, keterampilan antropometri, konseling gizi

Introduction

Noncommunicable diseases (NCDs) are a growing threat to all age groups, including adolescents. Risk factors such as sedentary lifestyles, unhealthy dietary habits—including the frequent consumption of high-fat, low-fiber processed foods—insufficient intake of fruits and vegetables, lack of physical activity, stress, and exposure to unhealthy environments, are prevalent among adolescents (Rofiqoch, 2020).

A study conducted in two senior high schools in Semarang revealed that 77,7% of the students consumed insufficient fruits and vegetables, 92,8% consumed excessive sugary foods, and 84,8% consumed excessive salty foods. Furthermore, 5,9% of the participants consumed excessive fatty foods, 0,5% consumed alcohol, 5,9% smoked, and 69,7% were physically inactive. Additionally, 36,1% of students were overweight, 43,0% had high blood pressure, and 23,0% had elevated blood sugar levels (Mintarsih et al., 2023). These findings underscore the urgent need for effective interventions to improve adolescent health. The Posbindu program (Integrated Development Post for the Prevention of Non-Communicable Diseases) is a national initiative aimed at promoting healthy behaviors through community-based efforts (Rohmayanti et al., 2021)

Implementing Posbindu programs in schools by empowering peer counselors such as Posbindu cadres can aid in the early detection of NCD risk factors within the school environment. For example, Senior High School 15 initiated such a program in 2022 by appointing 30 peer counselors as cadres with support from the Kedungmundu Health Center. However, these activities only occur semi-annually.

Adolescents often face barriers to accessing healthcare, leading to underutilization. This is partly due to low health awareness and the perception of good health, making routine check-ups seem unnecessary (Lestari et al., 2020a). Furthermore, health-related activities often clash during school hours.

The school-based Posbindu program includes several stations: registration, weight measurement, screening for NCDs, diagnosis of suspected conditions, and counselling/referral. Cadres, particularly those at stations III and IV, require skills in anthropometric assessments and nutrition counseling. Unfortunately, previous implementations revealed that cadres often lacked these essential competencie (Ranti, 2022).

In 2023, training on NCD knowledge and Posbindu operations was conducted, including practical sessions. Despite this, cadre performance in anthropometric measurements and counseling remained suboptimal. To address this, technical assistance in the form of structured mentoring is necessary to enhance cadre competencies in anthropometry and nutrition counselling (Noya et al., 2021).

This study aimed to assess the effectiveness of mentoring in improving knowledge and skills of posbindu cadres in anthropometry and nutrition counseling.

Methods

This study employed a quasi-experimental design with a pretest–post-test control group approach. The study was conducted from June to August 2024 in two senior high schools in Semarang: Senior High School 10 (control group) and Senior High School 15 (intervention group). The study population consisted of students from grades 11 and 12 in both schools. A total of 72 students (36 from each school) were selected through purposive sampling by the school guidance counselors. The inclusion criteria included strong empathy, respect for peers, and effective communication and listening skills.

The intervention involved educational mentoring using the booklet "I'm Ready to Be a

Posbindu Cadre" and a leaflet on "Nutrition Management for Non-Communicable Diseases." The equipment used included digital scales, microtoises, measuring tape, sphygmomanometers, and blood test kits. The independent variable was mentoring intervention. The dependent variables included knowledge about NCDs and Posbindu, anthropometric skills, and nutrition counseling skills.

The pre-test instrument was in the form of a. Data were collected through structured questionnaires on knowledge and observation checklists of skills. The knowledge data consisted of 40 multiple-choice questions covering Posbindu concepts and NCD prevention (e.g., hypertension, hyperglycemia, hypercholesterolemia, and hyperuricemia). Each correct response was scored as 1 and incorrect answers were scored as 0. Anthropometric and counseling skills were assessed using standardized performance checklists, which measured accuracy in height, weight, and waist circumference assessments, as well as communication skills, message clarity, and counseling structure. Observations were made by trained assessors during both pre- and post-intervention sessions.

Data normality was tested using the Shapiro-Wilk test. Homogeneity was assessed using a one-way analysis ANOVA. A multivariate independent t-test was used to determine the effect of the intervention with pre-test scores as covariates. The significance level was set at $P < 0,05$. The intervention group underwent two mentoring sessions involving lectures, discussions, demonstrations, and hands-on practice. Cadres performed repeated simulations and peer practice using actual equipment. The control group received only standard Posbindu socialization, without further mentoring. Posttest assessments were conducted two weeks after the final mentoring session to evaluate retention and skill acquisition.

This study was reviewed and approved by the Health Research Ethics Committee of Poltekkes Kemenkes Semarang (Approval Number: 0945/EA/KEPK/2024).

Result and Discussion

Cadre Characteristics

A total of 72 students participated in this study and were evenly distributed between the intervention and control groups (36 each). Participants were predominantly female (72,22% in the intervention group and 94,44% in the control group) and aged between 16 and 17 years. The grade distribution showed representation from grades I to III, with the majority from grades II and III. Statistical analyses revealed significant differences between groups in age ($p = 0,011$), sex ($p = 0,024$), and grade level ($p = 0,040$), which were considered as covariates in subsequent analyses.

The selection process ensured that cadres demonstrated empathy, good communication, and active involvement in health-related extracurricular activities, which are essential for effective Posbindu participation. The cadre characteristics in this study provide essential insights into the foundations of adolescent involvement in school-based health initiatives. The predominance of female students in both groups is consistent with previous findings indicating that females often show higher engagement in health promotion activities, potentially because of gender-related socialization in caregiving and peer support roles. The concentration of participants in grades II and III implies greater availability and maturity among senior students, aligning with their responsibilities as peer mentors. These demographic trends may influence initial competencies and receptiveness to training, explaining the observed disparities in baseline skills such as nutrition counseling.

Table 1. Cadre characteristics

Variable	Intervention		Control		p-value
	n	%	n	%	
Age (years old)					
14	0	0,00	2	5,56	0,011*
15	3	8,33	2	5,56	
16	15	41,67	26	72,22	
17	17	47,21	5	13,89	
18	1	2,78	1	2,78	
Gender					
Male	10	27,78	2	5,56	0,024**
Female	26	72,22	34	94,44	
Grade level in school					
I	16	44,44	9	25	0,040*
II	20	55,56	23	63,89	
III	0	0,00	4	11,11	

*Fisher Exact;
**Chi Square

Pre-Mentoring Scores of Nutrition Knowledge, Anthropometry Skills, and Nutrition Counseling Skills

The pre-test scores revealed that both groups had comparable levels of knowledge and anthropometric skills, with no significant differences (p = 0,868 and p = 0,205, respectively). However, counseling skills showed a significant baseline difference (p = 0,001), with the intervention group having higher mean scores (45,6) than the control group (32,8). This discrepancy was addressed using pretest scores as covariates in the multivariate analysis to ensure fair comparison similarity in baseline knowledge, and anthropometry scores indicated a relatively uniform understanding of health topics among the participants. However, a notable difference in counseling skills suggests preexisting variability in communication confidence and experience. This discrepancy likely stems from differences in previous exposure to peer mentoring or involvement in extracurricular health activities. The lower baseline in counseling for the control group underscores the importance of structured capacity-building, particularly for communication-based interventions.

Table 2. Descriptive of knowledge scores, counseling scores, and anthropometry skills scores of peer counselors before training and mentoring

Variable	Group								
	Intervention				Control				
	Mean	SD	Min	Max	Mean	SD	Min	Max	P*
Knowledge	79,0	7,38	63	90,0	78,7	6,86	57	90,0	0,868
Anthropometry kills	52,9	12,3	23	78,8	57,0	15,11	30	82,8	0,205
Nutrition Counseling Skills	45,6	17,65	13	90,0	32,8	12,45	7	53,0	0,001*

*One Way Anova

Effect of Mentoring on the Increase in Knowledge Scores, Anthropometry Skills Scores, and Nutrition Counseling Skills Scores

Following the intervention, significant improvements were observed in all three measured domains in the intervention group compared with the control group. Figure 1 and Table 2 show that in the intervention group, significant improvements were observed in all three measured domains compared to the control group. The knowledge scores increased by an average of 9,4 points (from 79,0 to 90,5; p < 0.001), anthropometry skills increased by 21,7 points (from 52,9 to 82,6; p < 0,001), and counseling skills increased by 36,2 points (from 45,6 to 81,4; p < 0,001). The mentoring program contributed 42%, 62%, and 64% to the improvement in these domains, respectively, as assessed by multivariate independent t-tests.

These findings suggest that structured mentoring is a robust and effective method for enhancing cadre competencies, and mentoring interventions have led to substantial improvements in all competency domains. This can be explained by the multimodal structure of the mentoring process that combines theoretical lectures, guided demonstrations, and active simulations. According to the cognitive learning theory, engagement through varied sensory channels enhances knowledge retention and skill acquisition. The structured mentoring approach created opportunities for scaffolding, progressively building on prior knowledge, which likely contributed to the observed outcomes. Consistency in improvement across domains strengthens the validity of the intervention, demonstrating that structured support can simultaneously enhance cognitive, psychomotor, and affective learning outcomes.

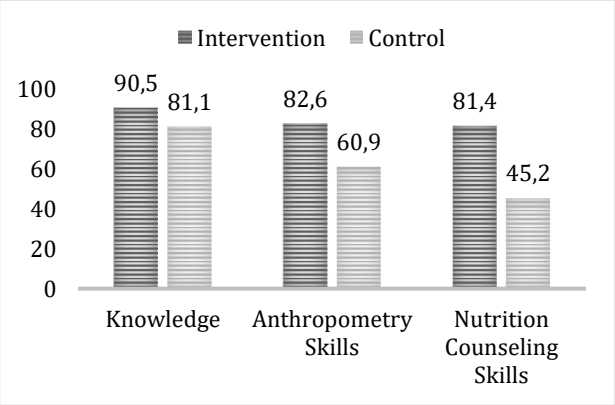

Figure 1. Difference in knowledge scores, anthropometry skills scores, and counseling scores of cadres between the control and intervention groups, controlled by each pre-test score

Table 3. The effect of mentoring on increasing knowledge scores, anthropometric skills scores and nutrition counseling skills scores

Variable	Group	Mean Score*	Mean Different (MD)	SE	t**	p	95% CI MD	Effectiveness
Knowledge Score	Intervention Control	90,5 81,1	9,4	1,4	7,0	<0,001	6,7 12,1	42%
Anthropometric Skill Score	Intervention Control	82,6 60,9	21,7	2,1	10,5	<0,001	17,6 25,9	62%
Nutrition Counseling Skill Score	Intervention Control	81,4 45,2	36,2	3,3	10,8	<0,001	29,5 42,9	64%

*Covariate appearing in the model are evaluated at the following values: Pretest knowledge score 78,8; pretest anthropometric skill score = 54,9; pretest counseling skill score 39,2
** Independen t test multivariat

Effectiveness of Mentoring in Increasing Cadre Knowledge Scores

Cadre knowledge is essential for posbindu activities. Adequate knowledge is required, especially for the activities listed in tables I-V. As shown in Table IV, cadres are expected to master various risk factors for non-communicable diseases and dietary management according to the results of health examinations. The mentoring material provided covered the concept of Posbindu, symptoms, causes of hypertension, hyperglycemia, hypercholesterolemia, hyperuricemia, and obesity, as well as dietary management for various risk factors (Kurniawan et al., 2024).

After receiving mentoring, cadres' knowledge scores increased. Figure 1 shows that the average cadre knowledge score in the intervention group (90,05) was higher than that of the control group (81,1). The level of cadre knowledge in both groups was categorized as good (score > 70,0). Most cadres had mobile phones that facilitated access to information through social media. This allowed cadres to be more frequently exposed to health and nutritional information from various media or other sources, which could increase their knowledge retention. One thing that was not controlled in this study was the extent to which social media influenced the level of cadre knowledge Independent t-tests showed that mentoring significantly increased the knowledge score of the cadres by 9,4 points. This was indicated by the statistical test results showing a highly significant effect of mentoring (MD, 9,4; 95% CI: 6,7 – 12,1, p<0,001). Mentoring contributed 42% to the increase in knowledge scores (Chen et al., 2024).

Nijiyati, Ifa et al. found a significant difference between pre-test and post-test knowledge scores. This proves that the provided training could improve the cadres' knowledge based on the Wilcoxon test (p=0,003)7. This finding is also in line with the research of Fatmah and Nasution, who showed that training increased post-test scores. Peter et al., in their research, concluded that training activities significantly influenced the improvement of cadre knowledge (Najiyati et al., 2019).

The level of cadre knowledge can also affect the cadre's activeness in carrying out activities at the posyandu (Fadjri & Jamni, 2020). This is one of the factors that make cadres enthusiastic about the training and mentoring provided.

Effectiveness of Mentoring in Improving Cadres' Anthropometry Skills

Cadres' skills were assessed based on their performance on anthropometry, which included weighing, measuring height, and measuring waist circumference. The cadres' basic anthropometric abilities were quite good. They could weigh using digital electric scales, measure their height with a microtoise, and measure their waist circumference.

However, cadres paid less attention to the precision of the tools, which should be calibrated beforehand. When weighing, they did not pay sufficient attention to the client's upright standing position. They were less careful in reading the height measurement results and often ignored the numbers after the decimal point. Height measurement results should be accurate to 0,1 cm. Additionally, they did not pay sufficient attention to the client's position during the measurement. They did not pay attention to the four body parts against the wall (head, back, buttocks, and heels). The cadres were not accurate in wrapping the

measuring tool exactly at the center of the client's navel to obtain accurate measurement results (Salahshoornezhad et al., 2022; Al Rahmad & Shavira, 2024).

Mentoring is an activity needed to provide cadres with knowledge and skills to improve the quality of services. The material in the media/guidebook was adjusted to the needs of the target with easy-to-understand language and attractive pictures. In addition to classical lectures and demonstrations, the chosen mentoring method also included direct practice of anthropometric skills on clients, who were their peers as the target of Posbindu activities at the school. Cadres practiced their skills repeatedly, so it was expected that they would become more skilled in anthropometry (Salem & Said, 2018).

After mentoring, there was an increase in cadre anthropometric skill scores. Figure 1 shows that the mean score of the intervention group (82,6) was higher than that of the control group (60,9). The skill level of cadres in the intervention group was categorized as good (score ≥ 70,0) after mentoring. In the control group, skill level was low (< 70,0).

The mentoring provided increased cadres' anthropometric skills by 21,7. The test results showed that this effect was significant, with a p-value < 0,001 (MD: 21,7, 95% CI: 17,6 – 25,9). Mentoring contributed 62% of the increase in the anthropometry skill scores of Posbindu cadres. This means that the provided mentoring was effective in improving the cadres' skills in conducting anthropometry in Posbindu activities at their school (Sudayasa et al., 2020).

Similar to Najiyati, Ifa et al. (2018), in their study in Dusun Jaten, Yogyakarta, revealed that not only did it affect knowledge, but it also increased cadres' skills in measuring height and weight, which significantly improved after receiving training. Cadres' skills are needed to avoid errors in carrying out their duties as Posbindu Cadres (Najiyati et al., 2019).

In a study by Astuti (2020), there was an increase in the knowledge and skills of cadres regarding Posbindu in Banguntapan Village, Yogyakarta. Lestari et al (2020b) initiated the formation of Posbindu, resulting in an increase in the knowledge and skills of cadres in the early detection of risk factors for non-communicable diseases in the community of Dusun Gunting, Pandak Bantul after receiving training (Astuti & Hastuti, 2020). Essentially, skills are inseparable from knowledge. Therefore, in this study, mentoring was also performed for anthropometric activities. The aim was to see the ability of cadres after receiving mentoring in using anthropometry measuring tools (Lestari et al., 2020b)

The results of this study are in line with those of previous studies, showing a significant increase in the knowledge and skills of posyandu cadres after receiving counseling and training. Other previous studies have also shown an increase in the accuracy of height measurement by posyandu cadres after receiving training and stated that the formation and mentoring of Posbindu PTM cadres can improve the knowledge and skills of cadres as well as increase community participation in Posbindu activities (Rohmayanti et al., 2021).

Effectiveness of Mentoring in Improving Cadres' Nutrition Counseling Skills

Nutrition counseling is a part of nutrition education aimed at helping individuals, groups, or communities to recognize and address their health and nutrition problems (Rohmayanti et al., 2021). Nutrition counseling as an approach used in nutrition care to help individuals and families gain a better understanding of themselves and the nutritional problems they face (Mintarsih et al., 2023). After receiving counseling, it is expected that individuals and families can take steps to address nutritional problems, including changes in eating patterns and solving nutrition-related problems towards healthy lifestyle habits (Ranti, 2022).

The Posbindu activities in Table IV, which involve nutrition counseling, require individuals to have good communication skills and mastery of nutrition and health-related materials. In Posbindu activities, there is still a need for guidance from health center staff, especially when providing nutrition counseling to clients with non-communicable disease risk factors, such as hyperglycemia, hypercholesterolemia, hypertension, and obesity.

Cadres' skills in conducting nutritional counseling were observed when they provided counseling to clients. The counseling material delivered was based on the results of health examinations conducted during Posbindu activities. In this study, media was prepared for cadres to conduct nutrition counseling, referring

to the material in the book "I'm Ready to Be a Posbindu Cadre" and using the leaflet "Dietary Management for Non-Communicable Diseases."

In general, cadres were quite good at communicating. They were able to be counselors for their peers at school, with good language, attitude, and eye contact. Adolescents appeared relaxed and interspersed with nonverbal language. The material that was still lacking was the basic understanding of nutritional problems related to non-communicable disease risk factors such as hypertension, hyperuricemia, hyperglycemia, hypercholesterolemia and obesity. The selection of healthy and nutritious foods and trendy foods should be limited when clients with NCDs are found. Cadres' efforts to improve their understanding of counseling materials were to more frequently access knowledge from various health media (Al Rahmad et al., 2023; Kaur et al., 2024).

After receiving mentoring, there was an increase in cadres' counseling skills scores. Table 3 shows that the average score in the intervention group (81,4) was higher than that in the control group (45,2). The skill level of cadres in the intervention group was categorized as good (score ≥ 70,0) after mentoring. In the control group, which did not receive mentoring, the skill level was still low (score < 70,0). It can be concluded that there was an increase in the nutrition counseling skills of cadres in the intervention group after receiving mentoring (Hargreaves et al., 2022).

The test results showed that mentoring cadres could increase their nutrition counseling scores by 36,2, and this increase was statistically significant (MD: 36,2, 95% CI: 29,5 – 42,9, p<0,001). Figure 1 shows that mentoring contributed 64% of the increase in nutrition counseling scores for posbindu cadres. This study proved that mentoring can improve cadres' skills in providing counseling to peers based on the results of adolescent Posbindu examinations at their school (Rusyantia et al., 2022).

Fatmah (2013) revealed that in research and community service, they were able to increase the capacity of cadres in conducting education using flipcharts and pocketbooks. (Pertiwi et al., 2020), in their research, found that by empowering Posbindu Mekarsari cadres, they were able to improve the knowledge and skills of cadres in anthropometry and education in Posbindu activities. However, this study had some limitations. First, the quasi-experimental design, which is suitable for school settings, does not completely eliminate the risk of selection bias, especially given the demographic imbalances. Second, the absence of long-term follow-up restricts the understanding of retention and behavioral change over time. Third, uncontrolled exposure to external information sources such as social media may have influenced the learning outcomes in both groups. Finally, logistical constraints in schools, such as time availability and staff support, may affect the replicability and sustainability of the mentoring program. These limitations underscore the need for future studies employing randomized controlled designs, extended monitoring, and broader application across diverse school contexts.

Conclusion

Structured mentoring has proven to be an effective approach to enhance the knowledge, anthropometric skills, and nutritional counseling abilities of adolescent Posbindu cadres. This intervention successfully addressed the essential competencies needed for the early detection and prevention of noncommunicable diseases in schools. This study confirms that adolescents, when provided with context-specific and practical learning opportunities, can act as capable health promoters among their peers.

Future research should focus on evaluating the sustainability of these improvements, addressing demographic balance, and assessing behavioral changes over time. Despite these limitations, this mentoring model shows strong potential for replication in other adolescent health promotion settings.

Acknowledgements

The authors are grateful to everyone who supported the study. The authors sincerely thank Semarang Health Polytechnic Ministry of Health Semarang for providing the facilities, documents, and respondents

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